RETROSPECTIVE IMMUNIZATION COVERAGE SURVEY

1998-99 Results (School Year 2002-03)

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ACRONYMS

4-3-1 Combination	DTP4-Polio3-MMR1
AAFP	American Academy of Family Physicians
AAP	American Academy of Pediatrics
ACIP	Advisory Committee on Immunization Practices
CDC	Centers for Disease Control and Prevention
CI	Confidence interval
DTP4	4 doses of diphtheria, tetanus, and pertussis vaccine
HEPB3	3 doses of hepatitis B vaccine
HIB3	3 doses of *Haemophilus influenzae* type b
KCI	Kansas Certificate of Immunization
KDHE	Kansas Department of Health and Environment
MMR1	1 dose of measles, mumps, and rubella vaccine
MMWR	Morbidity and Mortality Weekly Report
NIS	National Immunization Survey
Polio3	3 doses of polio vaccine
VAR1	1 dose of varicella vaccine

Retrospective Immunization Coverage Survey
1998-1999 (School Year 2002-2003)

Executive Summary

The Kansas Immunization Certificates (KCIs) for children five-years of age enrolled in a kindergarten class in a Kansas public school during the 2002-2003 school year were collected and evaluated for immunization coverage rates. The children included in this survey were born between September 2, 1996, and September 1, 1997, and the coverage rates refer to when they were two years old, which was between September 2, 1998, and September 1, 1999. Immunization coverage rates were also calculated for these children at 5 years of age. The results for this survey were measured against similar previous studies.

Eight hundred and twenty-four (824) Kansas elementary public schools were contacted by letter to participate. Responses from 10 schools indicated no kindergarten class. There was no response from 57 schools, leaving 738 schools for analysis. The 11,082 KCIs was a representative sample of the five-year old enrolled kindergarten at a public school.

Coverage rates for the entire state of Kansas and individual counties were calculated for 4 doses of diphtheria, tetanus, and pertussis (DTP4), 3 doses of polio (Polio3), 1 dose of measles, mumps, and rubella (MMR1), 3 doses of *H. influenza* (HIB3), 3 doses of hepatitis B (HEPB3), 1 dose of varicella (VAR1) and the combination of DTP4, Polio3, and MMR1 (4-3-1 combination). The statewide coverage rate for the 4-3-1 combination (that is, DTP4, Polio3, MMR1) was 79%. Even though not required for school entry, almost half (46.8%) of the children were vaccinated for VAR1 and this is a statistically significant increase compared to the 34% in previous survey. Statistically significant increases in coverage rates were also observed for HepB3 and statistically significant decreases were observed in coverage rates for Polio3.

Counties were grouped together based on their population density and then mean coverage rates were compared among these groups. Counties that were "sparsely populated" had higher mean coverage rates than counties with greater population densities (Moderately populated, Urban).

As in previous years, coverage rates were also calculated at 4, 6, 8, 17, and 20 months of age in order to determine at which age coverage rates begin to decrease. At 4 months of age, 93% of the children were up-to-date for immunizations. However, as the child's age increased, the coverage rates decreased. Immunization coverage rates declined by 20 percentage points between 4 and 8 months of age. After 8 months of age, immunization coverage rates began to increase until they reached 79% at 2 years of age.

Overall, Kansas immunization coverage rates of children by two years of age for the 4-3-1 combination have steadily increased from 57% in 1990-1991 to 80% in 2001-2002. Continued assessment and evaluation of the immunization rates are necessary to monitor progress toward the Healthy Kansas 2010 goal of 90% immunization coverage.

Retrospective Immunization Coverage Survey
1997-1998 (School year 2001-2002)

Objectives

To estimate the immunization coverage rates at the age of two years for children enrolled in the Kansas public school system during the 2002-03 school year.

Study Population

The study population included all children enrolled in kindergarten in the Kansas public school system during the 2002-2003 school year.

Study Design

The study was a stratified, cross-sectional survey, with each county representing a stratum. The characteristics of interest, or outcome variables, were the percentage of children who were fully immunized at two years of age against the diphtheria, tetanus, pertussis, polio, measles, mumps, rubella, *H. influenza*, hepatitis B virus, and varicella. Also, this was the first year to examine immunization coverage rates at five years of age.

Immunization coverage rates were measured for single vaccines and combinations of vaccines according to the recommended immunization schedule for children two years of age.[1] *The results of the survey refer to children who were born between September 2, 1996, and September 1, 1997. The coverage rates refer to the time these children were two-years-old, which is between September 2, 1998, and September 1, 1999 as well as coverage rates at five years of age when first entering school.*

Similar studies have been performed every year since the 1990-91 school year, except the 1991-92 school year. Confidence intervals (CI) have been calculated since the 1994-95 school year.

Sampling Techniques

The survey relied on a probability sample of children enrolled in all Kansas public schools with a kindergarten class. To ensure an adequate sample size in each county while maximizing the efficiency of the sampling process, a different sampling ratio was established for each county, and a probability sample was selected using a systematic sample technique.[2]

[1] The Recommended Immunization Schedule used, as reference for ages and immunization in this paper was the schedule approved by the Advisory Committee on Immunization Practices (ACIP), the American Academy of Pediatrics (AAP) and the American Academy of Family Physicians (AAFP) for the year 1995.

[2] The sample ratio is the ratio between the total enrollment in a school and the sample size, and it represents the proportion of enrolled children who are sampled.

Data Collection
All Kansas public schools with a kindergarten class received a letter co-signed by the Kansas Department of Health and Environment and Kansas Department of Education, requesting them to participate in the survey. The letter specified the number of records required to generate estimates of county-specific coverage rates (i.e., sample size) and outlined the process of systematically selecting a probability sample of records. Depending on the calculated sampling ratio for their county, each school was instructed to select all, every other, every third, every sixth, every fourteenth, or every sixteenth immunization record regardless of the size of the kindergarten class at that school. School administrators and school nurses were also advised to remove all personal identifiers, except date of birth, to ensure confidentiality of children. Copies of the immunization records and the current total number of kindergarten enrollees in each school were forwarded to KDHE.

Data Analysis
The immunization information from each record was entered into a computer file and then reentered for validity. The data were analyzed using SAS 8.2.

Point estimates of coverage rates and 95% confidence intervals (95% CI) for DTP4, Polio3, MMR1, 4-3-1 combination, HIB3, HEPB3, and VAR1 vaccines were calculated. A child was considered "up-to-date" for single vaccines if, at age two years, he or she had received at least four doses of DTP, (DTP4), three doses of Polio (Polio3), one dose of MMR (MMR1), three doses of *H. influenza* type b (HIB3), three doses of Hepatitis B (HEPB3), and one dose of the varicella (VAR1) vaccine. A child was considered "up-to-date" for the 4-3-1 combination antigen if he or she was up-to-date for all: DTP4, Polio3, and MMR1 vaccines. The statewide estimates took into consideration the complex survey design effect due to the stratification process and to the differences in sampling ratios among counties.[3]

These rates served as the means of comparing the 2001-02 and 2002-03 school year surveys and identifying those counties, which improved or declined in immunization coverage. Differences between estimates were considered significant if the 95% CI of the current year did not overlap with the 95% CI of the previous year.

Also, counties were grouped together based on their population density. Mean immunization coverage rates were compared among these groups. The population densities were calculated using population data from 1997 and were based on the formula used in the 2001 Annual Summary of Vital Statistics[4]. Counties were categorized into three groups. Those that were originally classified as Frontier or Rural were now classified as "sparsely populated". Counties, which were originally classified, as Densely-Settled, Rural, and Semi-Urban, were now classified as " moderately populated". And counties, which were classified as Urban, remained the same (Appendix 1).

Coverage rates were also calculated at 4, 6, 8, 17, and 20 months goal points. Each goal point coincides with a point two months after the end of the recommended age for administration of an

[3]Complex survey design effect was accounted for by using the SAS Procedure PROC SURVEYMEANS.

[4] http://www.kdhe.state.ks.us/hci/as01/as2001.html

immunization. For example at 2 months of age DTP1 and Polio1 are recommended. Therefore in order to include the two-month "grace period," children are evaluated at 4 months of age for receipt of DTP1 and Polio1. The 4month and 24 months goal points were used to assess the children that start their immunization series either on time or late and those who finish either on time or late. Finally, immunization coverage rates were calculated for this group of children at the time of their enrollment in kindergarten, that is, at the age of 5 years.

Results

Letters of invitation to participate in the survey were sent to 824 Kansas public schools. Twenty-eight schools reported not having a kindergarten class for the 2002-2003 school year and 57 did not respond. Data were received from and analyzed for 738 schools with kindergarten classes.

The number of children enrolled in kindergarten at the participating public schools was 31,034, which represents 83% of that birth cohort.[5] Approximately 17% of the birth cohort was not represented. Those not represented include children who attend private school, home school or other special schools. The number of immunization records received was 13,532. This represented an overall sampling ratio of 2.3, meaning that one child was selected for every 2.3 children enrolled. The sample size by county ranged from 7 to 381 records while enrollment ranged from 11 to 5,177.[6]

Of the 13,532 immunization records returned and examined, 11,082 (82%) were complete and had usable information of immunization history. This included children who were at least five years of age but less that six years of age on September 1, 2002. Of the 2450 children excluded, 1621 (66%) were not 5 years of age. The remaining records excluded had incomplete or unusable KCIs.

The immunization coverage rates for the all of the single vaccines and the 4-3-1 combination remained the same or increased compared to the coverage rates of the previous year. Polio3 was the exception and its coverage rate decreased by 4 percentage points compared to last year. As seen in Table 1 the greatest increase in coverage rates was seen in the VAR1, which rose 12 percentage points from 34% to 46.8% in just one year even though it is not required for school entry. Coverage rates remain high for HIB3 and HEPB3 even though they not required for school entry either. Immunization coverage rates have risen each year from 1990-91 through 1996-97 as displayed in Figure 1.

[5] 1997 Annual Summary of Kansas Vital Statistics.

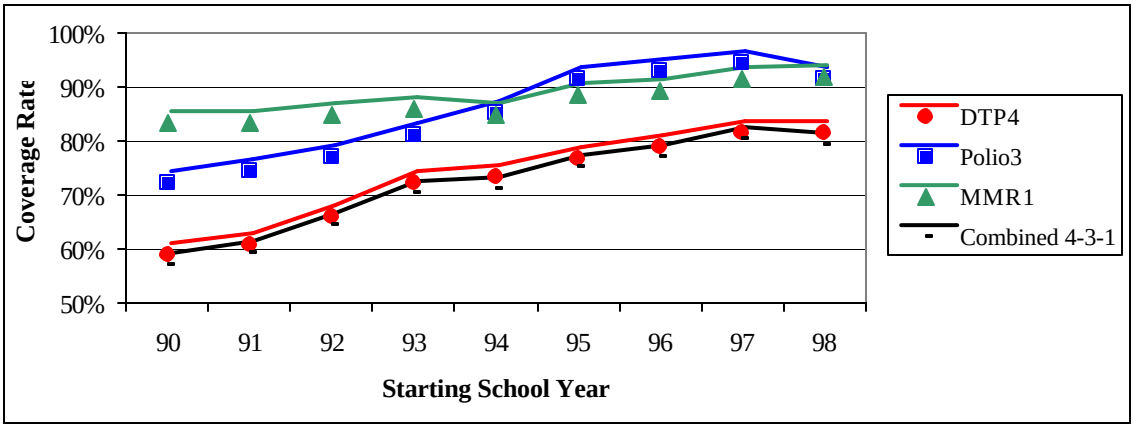
[6] Estimates from counties with small sample size (<50) may be unstable and changes in time should be interpreted with caution.

TABLE 1 **Kansas immunization coverage rates at the age of 2 years by vaccine from 1994-95 through 1997-98. *** Percentage up-to-date and 95% confidence interval

	1995-96		1996-97		1997-98		**1998-99**	
	%	95% CI	%	95% CI	%	95% CI	**%**	**95% CI**
DTP4	76.8	75.5 - 78.1	78.8	78.3 - 79.2	81.6	80.4 - 82.8	**81.5**	**80.3 - 82.7**
Polio3	91.4	91.4 - 92.3	93.0	92.7 - 93.3	94.5	93.8 - 95.2	**91.5**	**90.6 - 92.5**
MMR1	88.7	88.7 - 89.7	89.2	88.9 - 89.5	91.3	90.4 - 92.1	**92.0**	**91.1 - 92.8**
Combined 4-3-1	75.1	73.8 - 76.5	77.1	76.6 - 77.6	80.2	78.9 - 81.4	**79.3**	**78.0 - 80.6**
HIB3	81.9	80.5 -83.3	80.6	80.2 - 81.1	82.3	81.2 - 83.5	**83.9**	**82.8 - 85.1**
HEPB3	67.1	65.6 - 68.6	84.1	83.7 - 84.5	87.5	86.5 - 88.6	**90.4**	**89.5 - 91.3**
VAR1	N/A	N/A	14.5	14.2 - 14.9	34.0	32.4 - 35.5	**46.8**	**45.2 - 48.3**

* Based on the 1999-2000 to 2002-2003 school years' retrospective surveys.

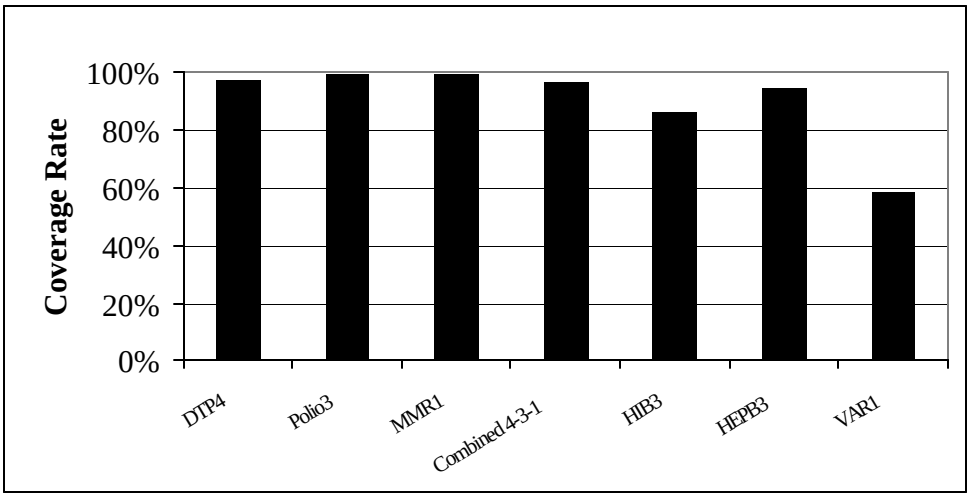
FIGURE 1 **Kansas immunization coverage rates at the age of 2 years by vaccine from 1990-91 through 1998-99. ***



* Based on the 1994-1995 to 2001-2002 school years' retrospective surveys.

Immunization rates of kindergarteners when they were five years old were also calculated (Figure 2). By age 5, at least 95% of the children are up-to-date for DTP4, Polio3, MMR1, HepB3, and the 4-3-1 combination, and over half of the children are up-to-date for VAR1. The greatest increases of coverage rates were for DTP4 and VAR1, which increased by 15.8 and 11.6 percentage points, respectively. These data show those immunization rates are higher when children are about to enter school than at the age of 2 years. School entry vaccination requirements are the most likely reason for this increase, although coverage rates for non-required vaccines increased also.

FIGURE 2 Immunization rates of Kansas kindergartners at age five years, 2002-03. *



*Based on the 2002-03 school years' retrospective surveys.

Appendix 2 shows the coverage rates for each individual county for the single vaccines and 4-3-1 combination. For single vaccines and 4-3-1 combination, the lowest coverage rate among individual counties decreased. The greatest range in coverage rates was found for VAR1 with difference of more than 86 percentage points (Table 2). Even though Polio3 expanded it's range by almost 5 percentage points, it still had the narrowest range in which each county had at least 82.7% of its children vaccinated against polio by age of two years.

TABLE 2 Range of percent of immunization coverage among Kansas counties, by vaccine, from 1995-96 through 1998-99. *

School Year	1995-96	1996-97	1997-98	**1998-99**
DTP4	57.1-100	65.0-100	68.4-100	**62.0-100**
Polio3	81.6-100	85.5-100	87.1-100	**82.7-100**
MMR1	76.7-100	81.6-100	79.2-100	**76.5-100**
Combined 4-3-1	56.0-100	63.5-100	67.9-97.0	**58.6-96.1**
HIB3	38.7-100	38.7-100	45.8-100	**45.2-100**
HEPB3	17.6-100	63.9-100	68.0-100	**67.1-100**
VAR1	N/A	0-41.3	7.7-72.2	**7.0-93.7**

* Based on the 1999-2000 to 2002-2003 school years' retrospective surveys.

The median values for the coverage rates among the counties has remained the same for the 4-3-1 combination and single vaccines except VAR1. Half of the counties have 42% coverage rates for VAR1. This is an increase in the VAR1 median from last year, which was only 28%. The highest median of 93% is for Polio3, MMR1, and HEP3.

Counties were categorized together based on their population densities. Mean coverage rates of the counties were compared among three categories (Table 3). Compared to the mean coverage rates of the other two groups of counties, the mean coverage rates for the "sparsely populated" counties was highest for the 4-3-1 combination and all vaccines except VAR1. Also with the exception of MMR1 and VAR1, mean coverage rates of the population density groups decreased as population density increased.

TABLE 3: Mean Immunization Coverage Estimates (%) Among Counties Based on Population Density.

	Sparsley Populated	Moderately Populated	Urban
DTP4	86.4	81.0	79.7
Polio3	94.4	92.2	90.7
MMR1	93.5	91.2	92.7
Combined 4-3-1	78.9	68.4	65.0
HIB3	90.4	83.8	82.3
HEPB3	93.0	90.3	89.3
VAR1	43.0	40.0	48.9

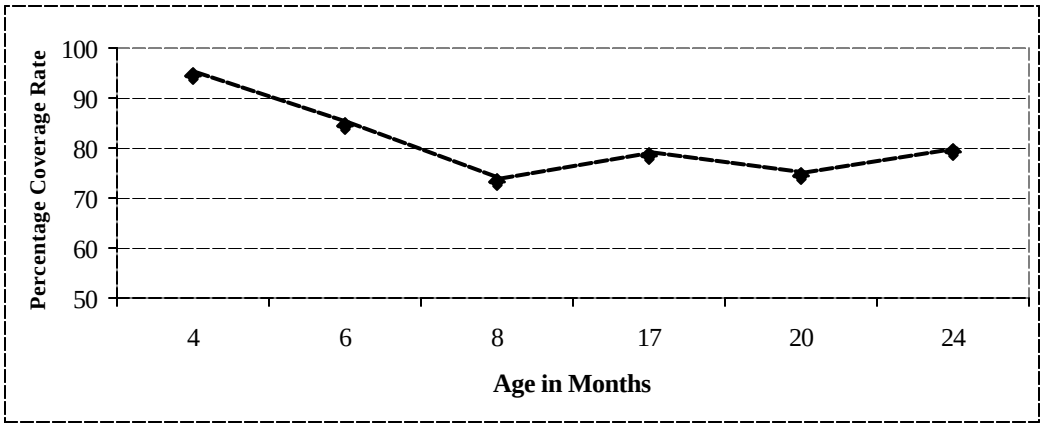
Up-to-date coverage rates for goal points at 4, 6, 8, 17, and 20 months were assessed for DTP, Polio, and MMR (Table 4, Figure 3). For reference, the coverage rates at 24 months have also been included. At 4 months of age at which only DTP1 and Polio1 are required, immunization coverage rates were at 94.3%. As the number of immunizations required to be up-to-date increased, coverage rates decreased.

TABLE 4 Percentage coverage rates at 4,6,8,17,20, and 24 months of age for Kansas in 1997-98 through 1998-99. *

Goal Point (Age)	School Required Vaccines	1997-98	1998-99
4 months	**DTP1, Polio1**	93.2	**94.3**
6 months	**DTP2, Polio2**	84.3	**84.4**
8 months	**DTP3**, Polio2	73.1	**73.3**
17 months	**DTP3**, Polio2, **MMR1**	76.8	**78.6**
20 months	**DTP4**, **Polio3**, MMR1	74.7	**74.5**
24 months	DTP3, Polio3, MMR1	77.1	**79.3**

*Based on the 2001-02 to 2002-03 school years' retrospective surveys.

FIGURE 3 Coverage rates at 4,6,8,17,20, and 24 months of age for Kansas in 1998-99. *

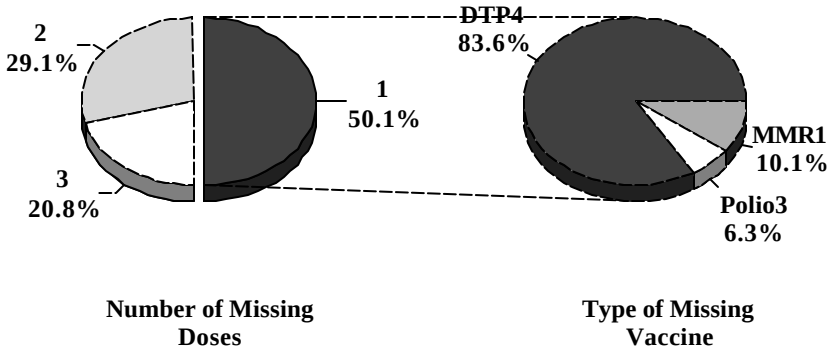


*Based on the 2001-02 to 2002-03 school years' retrospective surveys.

Of the 10,353 children in the sample who were up-to-date at 4 months of age, 8690 (84%) were still up-to-date at 24 months of age. Of the 729 children who were late at 4 months, only 250 (34%) caught up and were up-to-date at 24 months of age. This means that 66% of the children who are not up-to-date at 4 months of age do not catch u before 24 months, and children who start the series on time are 2.5 times more likely to complete the 4-3-1 immunization series by 24 months of age than those who begin the series late.

Of the children not up-to-date at 24 months of age, 50% (9.7% of total population studied) needed one additional immunization in order to be up-to-date (Figure 4). If these children had received one additional immunization the coverage rates for the 4-3-1 combination would have increased from 79.3% to 90.8%. For those children needing one additional immunization, 83.6% needed DTP4, 6.3% needed Polio3, and 10.1% needed MMR1.

FIGURE 4 Number and type of immunizations kindergarteners needed to be up-to-date at the age of 24 months, Kansas 1998-99. *



*Based on the 2002-2003 school years' retrospective survey.

Comments

Statewide immunization coverage rates remained at current levels in the 2002-2003 retrospective survey except VAR1 which had an increase of 12 percentage points compared to last year's retrospective survey. Since the children were five years old when this study was carried out, the results of the survey indicate the immunization coverage rates that were effective about three years earlier. Immunization coverage rates in Kansas for Polio3, MMR1, and HEPB3 have reached the Healthy People 2010 (HP2010) goal.[7] DTP4 and HIB3 are less than 10 percentage points from meeting this goal. Immunizations against hepatitis B (HEPB3), *H. influenza* (HIB3), and varicella (VAR1) are not required for school entry and thus not always recorded onto the KCI. For this reason the immunization coverage rates might actually be higher than presented. Also history of varicella disease was not examined. Children who have had history of varicella disease do not need to be vaccinated for varicella and therefore would negative affect the coverage rates.

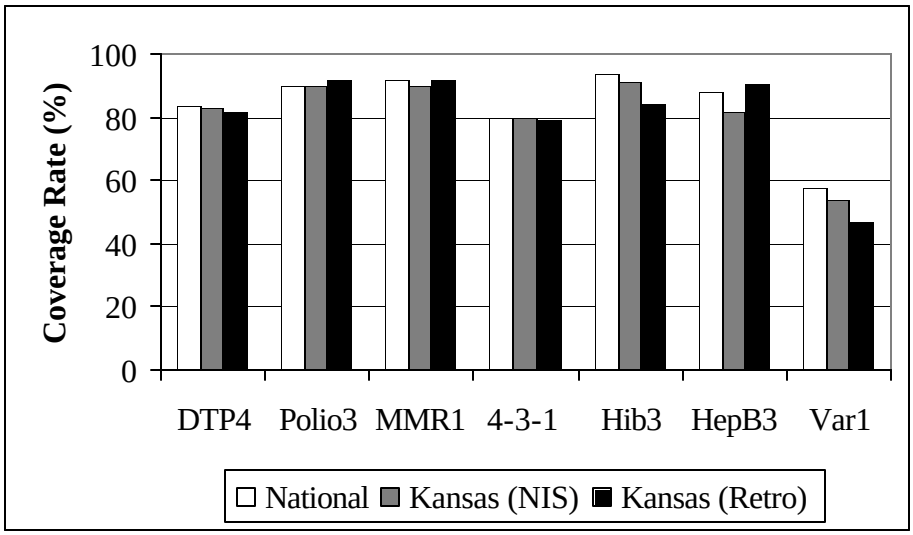
Counties were categorized based on their population densities. The mean coverage rate estimates were compared to determine if any variety exists among the population densities of the counties. Mean coverage rate estimates of the population density groups decreased as population density increased. Compared to the mean coverage rate estimates of the other two groups of counties (moderately populated, urban), the mean coverage rate estimates for the "sparsely populated" counties was highest for the 4-3-1 combination and all vaccines except VAR1 in which "urban" had the greatest mean coverage rate. "Urban", which are the most densely populated counties and represent 51% of the population, had the lowest coverage rate estimates for the 4-3-1 combination and all single antigens except MMR1 and VAR1. Targeting the population in the 5 "urban" counties in order to increase coverage rate estimates would have a large affect on the statewide coverage rate.

The results from this survey were compared with the results from the 1999 National Immunization Survey (NIS), which refers to the same time period in this retrospective survey (Figures 5, 6).[8] The results were compared to each other to confirm the coverage rates in the retrospective survey and to compare coverage rates in Kansas to the rest of the US. Data for the population-based NIS were collected by the Centers for Disease Control and Prevention (CDC) through a telephone survey of randomly selected households. For accuracy, the healthcare providers (family physicians, pediatricians, etc.) of the children included in the survey were contacted by mail. The coverage rates for HIB3 and VAR1 were significantly lower in the Retrospective survey when compared to the NIS results for Kansas. Possible reasons for the difference in rates is that neither HIB3 nor VAR1 are required for school entry, they may not be routinely recorded on the KCIs, and differences in sampling methodologies.

[7] Healthy People 2010 set goals of 90% coverage for DTP4, Polio3, MMR1, HIB3, HEPB3, and VAR1 among children aged 19 to 35 months.

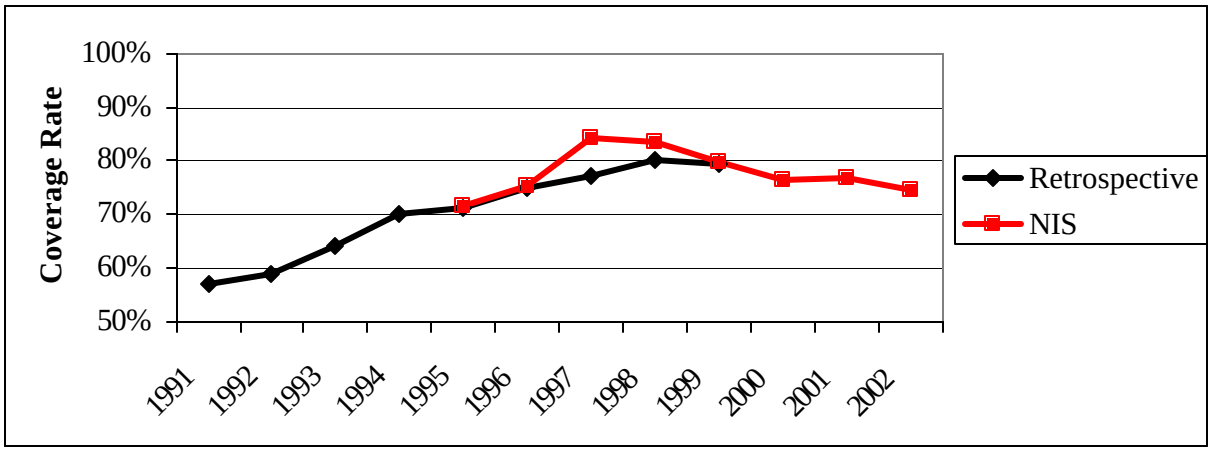
[8] *Morbity and Mortality Weekly Report;* 49 (26); 585-9.

FIGURE 5 Immunization Coverage Rates for the United States and Kansas. 1998-99. *



National and Kansas (NIS) rates were estimated by the National Immunization Survey 1999 and the Kansas (Retro) rates were estimated by the Retrospective Immunization Coverage Survey (1998-99).

FIGURE 6: Comparison of Immunization Coverage Rates for the 4-3-1 from the Kansas NIS and the Retrospective Survey, 1991-2002.



Only, 79.3% of all children were up-to-date for the 4-3-1 combination at 24 months of age. Of the children no up-to-date at 24 months of age, 50.1% (9.7% of population studied) only need one additional immunization in order to be up-to-date. For those children no up-to-date at 24 months of age, it is likely that an opportunity to administer all immunizations was missed. If those children missing just one immunization had been administered, then statewide immunization coverage rates for the 4-3-1 combination would have increased from 79.3% to 90.8%.

This survey had a few limitations. Most importantly this survey reports data that refers to immunization coverage rates, which occurred three years before the survey. The retrospective immunization survey only included children who were enrolled in kindergarten in a Kansas public school. Children who attended a private school or are home-schooled were excluded from the survey. However, the records analyzed are representative of 83% of this birth cohort, which is likely to ensure their validity. Also, no descriptive data were collected about race, ethnicity, or religious and medical exemptions.

Despite the limitations, the retrospective immunization survey provides a good estimation of the immunization coverage rates for Kansas. It allows state and local officials to identify and focus on the counties with low coverage rates. Recognition and focus on problem areas such as age and location can aid in Kansas achieving the 90% coverage rate goal. To this purpose, a similar survey is planned to be repeated next year.

APPENDIX 1: Kansas counties grouped together based on population density.

SPARSELY POPULATED		MODERATELY POPULATED	URBAN
Anderson	Mitchell	Allen	Douglas
Barber	Morris	Atchison	Johnson
Brown	Morton	Barton	Leavenworth
Chase	Nemaha	Bourbon	Sedgwick
Chautauqua	Ness	Butler	Shawnee
Cheyenne	Norton	Cherokee	Wyandotte
Clark	Osborne	Cowley	
Clay	Ottawa	Crawford	
Cloud	Pawnee	Dickinson	
Coffey	Phillips	Ellis	
Comanche	Pratt	Finney	
Decatur	Rawlins	Ford	
Doniphan	Republic	Franklin	
Edwards	Rice	Geary	
Elk	Rooks	Harvey	
Ellsworth	Rush	Jefferson	
Gove	Russell	Labette	
Graham	Scott	Lyon	
Grant	Sheridan	McPherson	
Gray	Sherman	Miami	
Greeley	Smith	Montgomery	
Greenwood	Stafford	Neosho	
Hamilton	Stanton	Osage	
Harper	Stevens	Pottawatomie	
Haskell	Thomas	Reno	
Hodgeman	Trego	Riley	
Jackson	Wabaunsee	Saline	
Jewell	Wallace	Seward	
Kearny	Washington	Sumner	
Kingman	Wichita		
Kiowa	Wilson		
Lane	Woodson		
Lincoln			
Linn			
Logan			
Marion			
Marshall			
Meade			

*Appendix2: Immunization Coverage Rates for Kansas Counties 1998-99**

COUNTY	DTP4	Polio3	MMR1	HIB3	HEPB3	VAR1	Combined 4-3-1
ALLEN	78.0	91.7	89.0	80.7	85.3	32.1	77.1
ANDERSON	85.7	94.0	97.6	91.7	92.9	44.0	84.5
ATCHISON	80.0	91.3	88.7	89.6	87.8	13.0	77.4
BARBER	82.5	92.5	95.0	97.5	95.0	22.5	82.5
BARTON	85.8	92.9	93.8	89.6	90.5	39.8	83.4
BOURBON	79.0	89.9	94.9	94.2	94.9	58.7	78.3
BROWN	76.8	90.2	90.2	61.0	93.9	14.6	76.8
BUTLER	83.7	90.6	94.0	91.0	92.7	40.3	82.0
CHASE	82.6	91.3	95.7	95.7	91.3	13.0	82.6
CHAUTAUQUA	82.1	89.3	89.3	89.3	92.9	14.3	82.1
CHEROKEE	68.2	90.2	86.3	83.5	85.9	31.8	68.2
CHEYENNE	87.5	95.8	95.8	95.8	91.7	33.3	83.3
CLARK	87.2	95.7	97.9	93.6	97.9	29.8	87.2
CLAY	95.7	98.6	97.1	85.7	94.3	54.3	94.3
CLOUD	86.6	97.6	96.3	95.1	96.3	36.6	86.6
COFFEY	82.3	91.7	94.8	90.6	93.8	47.9	78.1
COMANCHE	92.9	100	100	100	100	35.7	92.9
COWLEY	80.9	95.7	92.8	55.0	90.0	26.8	80.4
CRAWFORD	76.8	90.6	87.2	86.2	91.6	21.7	74.9
DECATUR	81.3	100	93.8	93.8	93.8	12.5	81.3
DICKINSON	84.3	91.0	92.1	91.6	91.6	43.8	83.7
DONIPHAN	88.4	92.8	89.9	91.3	88.4	15.9	88.4
DOUGLAS	84.7	93.1	96.9	92.0	91.6	55.9	83.5
EDWARDS	86.2	93.1	93.1	100	96.6	62.1	86.2
ELK	85.7	100	95.2	95.2	95.2	38.1	85.7
ELLIS	88.2	96.9	95.9	94.9	95.4	44.6	88.2
ELLSWORTH	89.6	93.8	87.5	93.8	97.9	56.3	85.4
FINNEY	79.0	90.6	89.1	84.1	91.3	50.7	77.5
FORD	78.3	93.9	90.4	85.2	83.5	45.2	75.2
FRANKLIN	78.1	88.0	89.3	87.6	86.7	57.9	76.0
GEARY	81.7	90.2	89.8	91.5	91.9	38.3	78.3
GOVE	78.3	91.3	100	87.0	87.0	39.1	73.9
GRAHAM	87.0	87.0	91.3	82.6	91.3	39.1	87.0
GRANT	85.2	97.8	93.3	94.1	94.1	71.1	83.7
GRAY	79.4	93.7	92.1	84.1	84.1	46.0	79.4
GREELEY	83.3	91.7	91.7	91.7	83.3	50.0	83.3
GREENWOOD	85.5	91.9	91.9	69.4	93.5	24.2	83.9
HAMILTON	72.0	96.0	88.0	84.0	96.0	44.0	72.0

**** Based on the 2002-2003 school years retrospective surveys.***

*Appendix2: Immunization Coverage Rates for Kansas Counties 1998-99**

COUNTY	DTP4	Polio3	MMR1	HIB3	HEPB3	VAR1	Combined 4-3-1
HARPER	94.0	100	100	96.0	98.0	38.0	94.0
HARVEY	81.7	93.6	90.6	82.2	90.1	41.6	79.2
HASKELL	64.7	88.2	76.5	88.2	100	64.7	64.7
HODGEMAN	87.5	93.8	100	93.8	93.8	75.0	87.5
JACKSON	86.5	92.9	92.9	51.6	67.1	22.6	84.5
JEFFERSON	81.3	93.1	93.8	91.0	88.2	57.6	80.6
JEWELL	91.3	100	100	91.3	95.7	21.7	91.3
JOHNSON	82.1	90.4	94.4	80.8	88.7	60.6	79.5
KEARNY	83.3	100	92.6	90.7	88.9	57.4	83.3
KINGMAN	80.0	95.0	88.3	93.3	88.3	23.3	78.3
KIOWA	100	93.1	93.1	93.1	93.1	51.7	86.2
LABETTE	74.1	86.4	85.1	45.2	88.2	46.9	72.8
LANE	93.8	93.8	93.8	93.8	93.8	93.8	93.8
LEAVENWORTH	82.4	93.9	94.2	78.3	89.6	40.5	79.8
LINCOLN	96.2	100	100	96.2	92.3	34.6	96.2
LINN	76.4	85.5	90.9	86.4	94.5	50.9	76.4
LOGAN	88.2	94.1	94.1	94.1	94.1	35.3	88.2
LYON	86.1	95.9	96.4	84.5	92.3	27.3	85.6
MARION	94.7	97.7	96.2	95.4	91.6	19.8	94.7
MARSHALL	82.9	92.1	90.8	89.5	94.7	38.2	81.6
MCPHERSON	83.8	94.4	91.0	84.2	90.2	51.3	82.1
MEADE	93.1	96.6	96.6	96.6	86.2	48.3	93.1
MIAMI	83.7	93.5	90.8	88.6	92.4	37.0	82.1
MITCHELL	90.9	97.7	100	97.7	97.7	29.5	90.9
MONTGOMERY	80.5	91.2	90.6	85.5	89.9	64.2	79.9
MORRIS	81.0	93.7	88.9	84.1	95.2	31.7	81.0
MORTON	97.5	97.5	97.5	95.0	97.5	65.0	95.0
NEMAHA	93.6	98.2	95.5	99.1	93.6	10.9	91.8
NEOSHO	74.1	88.8	87.4	88.8	88.8	6.99	74.1
NESS	87.5	96.9	93.8	96.9	96.9	62.5	87.5
NORTON	86.4	93.2	90.9	81.8	93.2	38.6	84.1
OSAGE	85.7	95.6	94.0	73.6	91.8	44.0	84.6
OSBORNE	87.5	90.6	87.5	87.5	87.5	56.3	84.4
OTTAWA	89.3	89.3	92.9	92.9	96.4	28.6	85.7
PAWNEE	96.1	100	98.0	100	100	66.7	94.1
PHILLIPS	88.9	93.3	91.1	95.6	95.6	35.6	86.7
POTTAWATOMIE	89.8	94.0	95.2	91.6	96.4	48.8	88.0
PRATT	84.5	94.4	97.2	91.5	98.6	25.4	84.5

**** Based on the 2002-2003 school years retrospective surveys.***

*Appendix2: Immunization Coverage Rates for Kansas Counties 1998-99**

COUNTY	DTP4	Polio3	MMR1	HIB3	HEPB3	VAR1	Combined 4-3-1
RAWLINS	81.3	87.5	81.3	93.8	100	50.0	81.3
RENO	82.2	93.1	92.4	91.6	90.9	48.7	80.4
REPUBLIC	87.5	100	100	93.8	96.9	46.9	87.5
RICE	88.1	91.7	95.2	79.8	96.4	59.5	84.5
RILEY	83.9	91.7	95.0	62.2	94.4	46.7	81.1
ROOKS	95.7	97.9	100	100	100	78.7	93.6
RUSH	92.9	96.4	96.4	100	92.9	28.6	92.9
RUSSELL	80.0	93.3	93.3	95.6	95.6	48.9	80.0
SALINE	85.3	94.5	93.7	87.8	92.4	41.2	84.5
SCOTT	93.3	95.6	95.6	86.7	93.3	64.4	91.1
SEDGWICK	84.7	91.6	90.9	89.2	93.7	53.3	81.2
SEWARD	77.7	93.7	88.2	81.6	86.1	27.6	74.8
SHAWNEE	82.3	92.5	94.0	85.0	90.1	36.3	81.7
SHERIDAN	95.0	100	100	100	100	35.0	95.0
SHERMAN	92.6	98.5	97.1	95.6	92.6	20.6	92.6
SMITH	93.5	93.5	93.5	90.3	93.5	48.4	93.5
STAFFORD	85.7	90.5	92.9	69.0	95.2	40.5	85.7
STANTON	81.8	90.9	95.5	90.9	90.9	68.2	81.8
STEVENS	72.9	93.2	79.7	83.1	74.6	33.9	67.8
SUMNER	77.7	90.4	88.5	86.0	88.5	29.9	75.5
THOMAS	86.0	96.5	94.7	96.5	91.2	50.9	86.0
TREGO	90.9	90.9	100	90.9	90.9	90.9	90.9
WABAUNSEE	82.6	100	89.1	93.5	95.7	54.3	78.3
WALLACE	85.7	100	85.7	100	85.7	42.9	85.7
WASHINGTON	89.7	94.9	98.7	91.0	98.7	62.8	89.7
WICHITA	75.8	90.9	90.9	81.8	84.8	42.4	75.8
WILSON	72.4	85.7	84.7	82.7	88.8	37.8	66.3
WOODSON	85.2	85.2	85.2	81.5	88.9	33.3	85.2
WYANDOTTE	62.0	82.7	84.2	68.4	82.3	47.0	58.6

**** Based on the 2002-2003 school years retrospective surveys.***